BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Biomedical Science Pearson BTEC International Level 3 Diploma in Environmental Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Biomedical Science Pearson BTEC International Level 3 Extended Diploma in Environmental Science
Unit number and title	**Unit 6: Principles and Applications of Chemistry II**
Learning aim(s)	**B:** Understand how rate and equilibrium influence chemical reactions
Assignment title	**Rate of reaction and chemical equilibrium**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a junior technician in an industrial laboratory and your supervisor has sent you on a training course. The course covers rates of reaction and chemical equilibrium, which are important factors to take into account when for example manufacturing a wide range of products, such as new pharmaceutical drugs for medical use. The time it takes to complete a chemical reaction can have an effect on the yield of product produced in a given time and therefore also affects the cost of the product. You supervisor sees it as vital that you and the other technicians in the department have a good understanding of these factors that optimise the yield in a given time of any new products that your Company may develop. At the end of the training programme you will be expected disseminate what you have learnt to the other members of your department through a well-constructed report.

Task	Your training is in two parts, the first to investigate the effect of the four key factors (i.e. concentration, surface area, temperature and catalysis) upon the rate of a reaction and the second is to investigate factors which effect a system in dynamic equilibrium. **Investigate** practically how the factors of concentration, surface area, temperature and catalysis affect rates of reaction. You should: ● Use methods such as losing mass over time, volume of gas over time or timed clock/colour change reactions. ● Carry out suitable risk assessments before starting any practical work. ● Collect sufficient data to plot graphs using appropriate labels with units and scale. Draw a smooth best-fit curve through the points and

	exclude any anomalies. Explain conclusions drawn for each factor using the collision theory, activation energy and scientific terminology accurately**.** ● Draw tangents at appropriate points on the graph and accurately determine the rate of reaction at the start, middle and near the end of the reactions. **Analyse** the values of the rates, identify how the rate changes and explain what is happening at molecular level using collision theory. Compare the initial rates for different graphs and as the factor under investigation changes establish if a directly proportional relationship is identified. Give a scientific explanation if a directly proportional relationship is present or if there is no relationship identify potential errors and issues from the experiment Carry out a combination of practical and research based **investigations** to provide a complete overview of the effect of concentration, pressure, temperature and catalysis on a system in dynamic equilibrium. You should: • Provide experimental results including observations on the effect on the equilibrium position when at least one factor has been changed. Apply Le Chatelier's Principle using the reversible reaction equation and enthalpy change to predict an equilibrium position change when one reaction condition is changed. ● Write expressions for equilibrium constants (K_c) for a range of systems in equilibrium. **Calculate** equilibrium constants, concentrations of reactants or products using the correct units for reactions at equilibrium. Comment on the values of K_c in terms of the equilibrium position and how far the reaction has gone to completion. Comment on the extent of the equilibrium position and the direction of enthalpy change when values of K_c for the same reaction at different temperatures are provided. ● Research or use **two** given case studies of the industrial manufacture of a chemical product that involves a chemical equilibrium. **Justify** why operational conditions would give the optimum rate and yield. Use the collision theory and Le Chatelier's principle to explain ideal conditions for rate and product yield and why a compromise might be necessary. Suggest other methods and solutions to compensate for a low rate or yield. You should write up your investigations and findings in to a report that can be used by your colleagues to fully understand factors that will effect the yield in a given time for products that may be produced by your Company.
Checklist of evidence required	A detailed report that includes: ● Practical investigations of a range of factors affecting the rate of a reaction. ● Practical or researched investigations of factors affecting a system in dynamic equilibrium.

	● Graphs to analyse gradients and determine rates of reaction. ● Calculations involving the equilibrium constant. ● Industrial equilibrium processes with operational conditions that produce the optimum rate and yield of product.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
B.D2	Justify operational conditions for industrial equilibrium processes to obtain the optimum rate and yield of product.
B.M2	Analyse gradients from tangents of graphs to accurately determine rate of reaction.
B.M3	Carry out calculations involving K_c and interpret changes in values with temperature
B.P2	Investigate factors that affect rate of reaction
B.P3	Investigate factors that affect systems in dynamic equilibrium
Sources of information to support you with this Assignment	All sources of information suggested are UK based. Centres are free to amend these sources to those available in the Country of delivery where more appropriate. www.edu.rsc.org - practical resources; - Nuffield chemistry practical collection www.STEM.org.uk - rates of reaction - chemical equilibrium Within the copyright laws learners could search YouTube for – rates of reaction and chemical equilibrium – variety of clips
Notes to the Assessor and technician	The practical activities suggested for this assignment are required to be safety checked by the Centre before use. Pearson Education can take no responsibility for the safety of any practical activities. Before doing any practical activity, you should always carry out your own risk assessment and refer to the necessary regulations. In particular, any local rules issued by your employer must be obeyed, regardless of what is suggested here. Centre should use Health and Safety information provided by a reputable source. In the UK such an example organization is CLEAPSS http://science.cleapss.org.uk/